

and snow. If this means that the snow will not be melted easily, because it cools the air, there is self-contradiction. Snow can only cool the air by abstracting heat from it, and if snow takes up the heat, the heat is spent in melting it. As for what is said about cold rendering air diathermatous, so much the better for the melting. If the sun's rays can readily pass through the air, they will the more readily reach the snow which they have to melt. These paragraphs are not worthy of the book."

Has not Mr. Hill misapprehended Dr. Croll's argument?

It appears to me to be of this kind. Regarding climate as the average condition of the atmosphere in respect to heat, and considering the atmosphere as in the main warmed, not directly by the radiant heat of the sun, but by contact with the warmed surface of the earth, then if under any arrangement of circumstances a portion of the earth's surface can remain permanently at a low temperature, the air in contact with that portion of surface (*i.e.* the climate of the region) will also be permanently cold.

Now since the heat that goes to melt snow and ice disappears as sensible heat and produces no rise in temperature, we have a case in point—a permanently cold surface—in regions covered with snow and ice as long as any of the frozen water remains unmelted. The presence of accumulated masses of snow and ice in any region would therefore result in a far *colder climate* than might be expected, taking into consideration only the amount of heat received from the sun. For as long as the temperature of the air is 32° F. or lower, whatever aqueous vapour falls will fall as snow, not as rain; therefore, while snow and ice remain, accumulation will probably not cease, even during the summer. Moreover, although the aqueous vapour coming from warmer regions, on condensing and crystallizing into snow, gives out heat, will that heat avail to raise the general temperature of the air above freezing-point? Will not much of it be lost into stellar space?

To sum the matter up, it is clear that if by some natural process the heat received in polar regions could be transmuted into some other form of energy, while that received in equatorial regions produced the ordinary heating effects, very different climatic conditions would prevail, even if it were possible that the actual amount of heat received in the two regions were the same. In snow-covered countries the bulk of the sun's heat received goes in the work of melting snow and ice, and produces therefore no effect in ameliorating the climate.

R. D. ROBERTS.

Jan. 21st, 1880.

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WE regret to record the death of Professor Baron von Seebach, Director of the Geological Museum, Göttingen. He was not only eminent as a man of science, but endeared by ties of warm friendship to a large circle of friends, who will deeply deplore his loss.

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ERRATUM.—In Mr. Clement Reid's paper, "The Glacial Deposits of Cromer," *GEOL. MAG.* Feb. 1880, at p. 56, the bracket for 'Lower Glacial' should not include the 'Forest Bed.'